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The increase of γ-radiation from the ground in Sweden (1950–1959) caused by fallout from nuclear weapon tests

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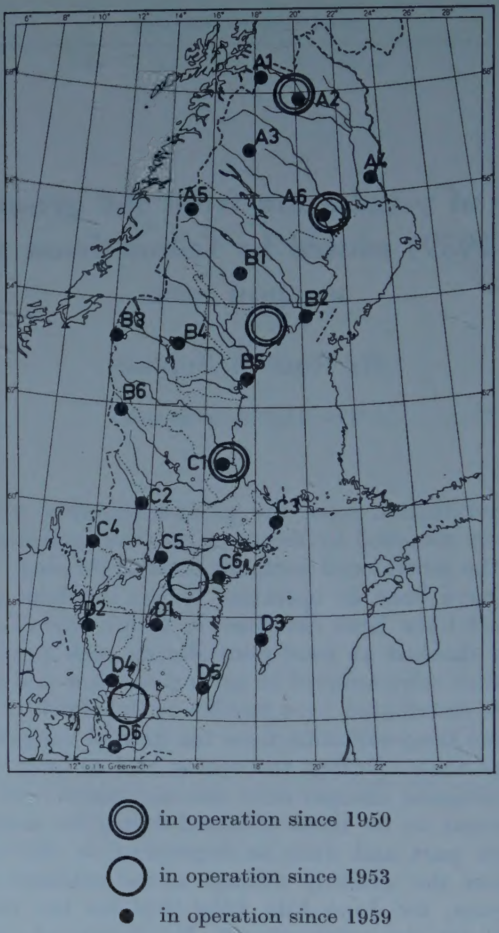
With 4 figures in the text

Since 1950 the γ-radiation from the ground, together with cosmic radiation, has been continuously recorded by means of pressure ionization chambers situated at four stations in the central and northern parts of Sweden; while since 1953 two additional stations have been in operation in the southern part of the country. The instruments used have been described in Tellus 1956 (1). The stability of the apparatus has been checked at least once during each year by means of a radium source. The sites were selected so as to give a low and constant background and the stations are distributed over Sweden as indicated by the circles in Fig. 1.

During winter time the γ-radiation from the ground varies considerably because of absorption in the snow. During the spring and autumn when the ground is subject to freezing irregular changes have also sometimes been observed. The most reliable data was found to be those obtained during the months May to September in the southern part and June to September in the northern part of the country. Fig. 2 shows the monthly average of the radiation observed in per cent of the average figures, for June–July 1950–1953 for the northernmost stations and June–July 1953 for the southernmost. No significant increase in the γ-level was observed before 1953. The first indication of a higher level was found in August, 1953 after the thermonuclear weapon test over the northern hemisphere, which gave the curves shown in Fig. 3. During 1954 there was no clear change but in 1955 the weapon tests during July caused an increased amount of fallout particularly in the southern part of Sweden. Similar amounts were observed in the summers of 1956 and 1957, causing a maximum increase of the average γ-radiation of the order of 10 % of the average natural radiation in the places concerned which is about 1.2 mr per week. In the last part of the relatively rainy summer of 1958 the radiation rose to values of the order of 20 % higher than the natural radiation and the tests over the northern hemisphere in September–October 1958 brought such quantities of fallout that in May–June 1959 there was still a 10–15 % higher radiation level than there had been before 1953. During the summer of 1959 the radiation decreased considerably and by September it was only about 50 % of the maximum observed. To a certain extent this could be explained by the unusually dry summer. The lack of rain can, however, hardly be the reason for this decrease in fallout, as measurements of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12° ö f. Greenwich
◎ in operation since 1950
○ in operation since 1953
● in operation since 1959

Fig. 1. The Institute of Radiophysics' stations for automatic recording of γ-radiation from the ground.

the debris in the atmosphere at ground level also gave low values during the late part of the summer 1959 as is seen in Fig. 4. Consequently, assuming there were no particular meteorological conditions causing a special fallout situation this summer, the fallout in northern latitudes seems to have come down much more rapidly than was earlier thought likely.

The measurements communicated here show that, at least as far as the fallout from the September–October tests 1958 is concerned, most of the radioactivity has come down within 6–8 months.

The γ-radiation during the weeks following a nuclear weapon test in the northern hemisphere sometimes shows a very irregular distribution. Therefore the number of γ recording stations has now been increased to a total of 30 distributed over all parts of Sweden as shown in Fig. 1.

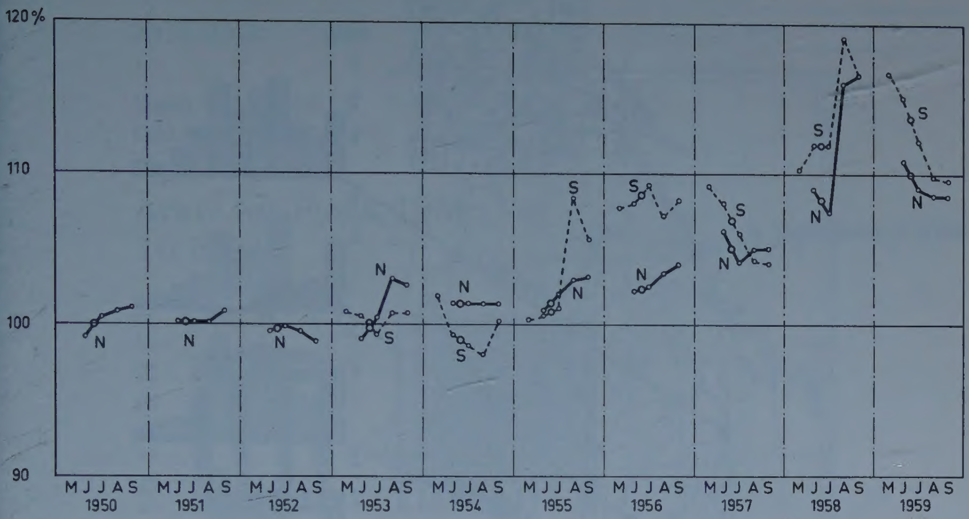

Fig. 2. Average values of γ-radiation from the ground during June (May)–July at four northern stations (N) and two southern (S) in per cent of the average values for June–July during 1950–1953 and 1953 respectively.

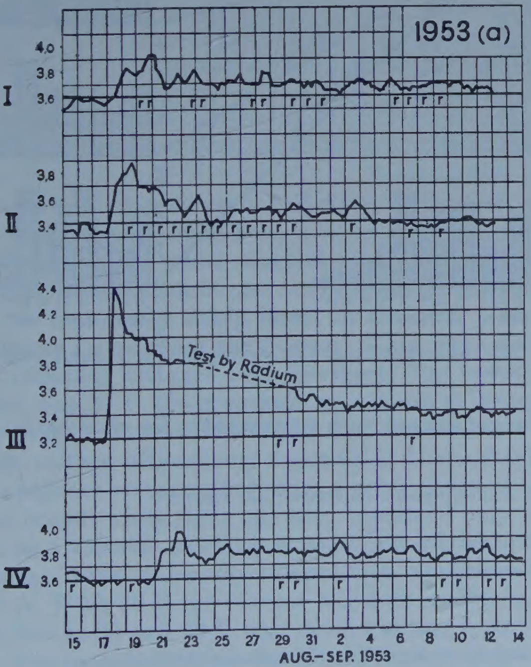

Fig 3. γ-radiation records during August 1953. The peak in curve III corresponds to about 1 c fission products per sq. kilometers.

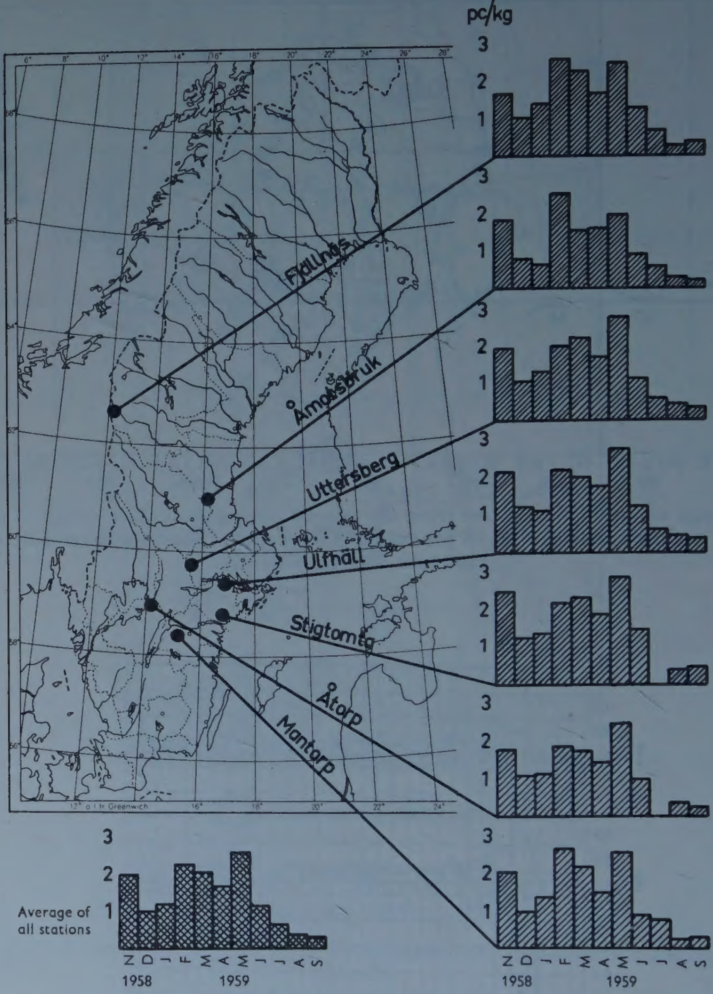

Fig 4. The radioactivity of the atmosphere at ground level.

The stations will be completed with instruments for the continuous recording of airborne radioactivity.

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